

## Workshop Manual

Audi A6 2011 ➤

Audi A6 China 2012 ➤

Audi A8 2010 ➤

Audi Q5 2008 ➤

**Basic information on high-voltage vehicles**

Edition 09.2015



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## List of Workshop Manual Repair Groups

### Repair Group

00 - Technical data



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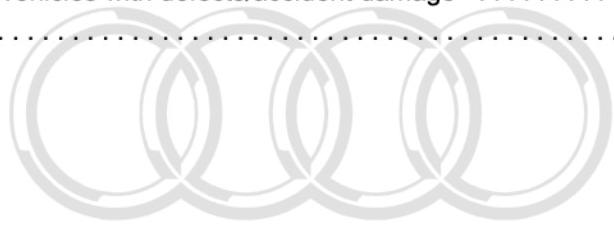
Technical information should always be available to the foremen and mechanics, because their careful and constant adherence to the instructions is essential to ensure vehicle road-worthiness and safety. In addition, the normal basic safety precautions for working on motor vehicles must, as a matter of course, be observed.

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# Audi

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## 00 – Technical data

### 1 Distinguishing features of Audi high-voltage vehicles

(ARL004402; Edition 09.2015)

#### 1.1 Distinguishing features (exterior)

Audi vehicles with a high-voltage electrical system can be recognised from the following exterior features:

- ◆ Hybrid lettering on the wing panels
- ◆ Hybrid lettering on the rear lid



#### 1.2 Distinguishing features (interior)

Audi vehicles with a high-voltage electrical system can be recognised from the following interior features:

- ◆ Hybrid lettering on the engine cover panel
- ◆ Instrument cluster with power meter and hybrid displays
- ◆ MMI system with hybrid display
- ◆ Hybrid lettering on the sill panels
- ◆ Switch for EV mode and gear selector with tip-5 function

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## 2 Qualification of internal/external personnel

### 2.1 Training profiles and focus of training

Training profile	Areas of responsibility	Focus of training
»Electrically instructed person (EIP)«  All persons working on any hybrid vehicle in an Audi Service workshop must be qualified EIPs. All other employees must have been given a safety briefing for electric vehicles (safety instruction).	◆ May carry out general work and maintenance on the vehicle  ◆ Responsibilities include service work such as battery change, service inspection, wheel change  ◆ May carry out mechanical work on a de-energised high-voltage system as delegated by the high-voltage technician	◆ Only qualified Audi high-voltage technicians are authorised to act as EIP trainers. The training course is held internally.
»High-voltage technician (HVT)«  Any Audi partner performing work on a vehicle with a high-voltage electrical system must have at least one employee qualified as a HVT	◆ May de-energise the vehicle or confirm that it is already de-energised and may safeguard it against re-energising  ◆ May train employees as EIPs and delegate work to them on the high-voltage system	◆ Technical responsibility  ◆ De-energising procedure  ◆ Function and operating modes of the hybrid vehicle
»High-voltage technician - HVT, with product training«  2-day HVT training course and 2-day training course on Audi high-voltage vehicles/electric drive system diagnostics	◆ May perform fault-finding on the high-voltage system	◆ Diagnostics on high-voltage system  ◆ Coolant circuits  ◆ New 12 Volt components  ◆ Networking and topology  ◆ Function of high-voltage components
»Audi specialist for work on high-voltage systems/high-voltage expert - HVE«  2-day HVT training course and 2-day training course on electric drive system diagnostics 5-day training course for work on high-voltage systems	The Audi specialist for work on high-voltage systems defines the work to be performed on energised vehicles in cases where a vehicle cannot be de-energised. This specialist is employed by the Importer	◆ Vehicle cannot be de-energised  ◆ High-voltage test equipment  ◆ Standards and regulations  ◆ Electrical and chemical hazards  ◆ Basic principles of high-voltage systems

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## 2.2 Qualifications and work for road-side assistance, basic partner/specialist centre partner and Importer

Work	Road-side assistance	Basic partner		Specialist centre partner		Importer
	»Electrically instructed person - EIP«	»Electrically instructed person - EIP«	»Audi high-voltage technician - HVT, with product training«	»Electrically instructed person - EIP«	»Audi high-voltage technician - HVT, with product training«	»High-voltage expert - HVE«
Breakdown assistance at roadside	yes	—	—	—	—	—
Service, standard repairs (not HV-related), GFF	—	yes	yes	yes	yes	yes
Deactivating high-voltage system	—	—	Diagnostic de-energising only, no manual de-energising	—	Diagnostic and manual de-energising	Diagnostic and manual de-energising
Fault finding and repairs on high-voltage system (except repair of high-voltage battery)	—	—	—	—	yes	yes
Renewing control unit for high-voltage battery	—	—	—	—	yes	yes
Further repairs to the high-voltage battery	—	—	—	—	—	yes



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### 3 Handling high-voltage vehicles

#### 3.1 Types of voltage and current in the high-voltage section of an Audi vehicle

Within the active high-voltage section, direct current flows through the electric air conditioner compressor, the high-voltage battery and the power electronics. Direct voltage is present across these components. The electric drive motor - V141- uses alternating current/alternating voltage. In addition, the power electronics system uses a capacitor to store electrical energy. This component is **actively discharged when the ignition is switched off.**

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#### 3.2 Current and voltage hazards

- ◆ Alternating voltages of approx. 25 V and higher and direct voltages of approx. 60 V and higher are dangerous. Electrical currents passing through the human body can be felt at approx. 5 mA and higher. A tingling sensation can be felt, but it is still possible to let go of the electrical conductor.
- ◆ The threshold at which the current flow induces muscle contractions, making it impossible to let go, begins at approx. 10 mA. This reflex of holding on to the power source significantly increases a person's exposure to the adverse effects of the electrical current. Extended exposure to alternating current at 30 - 50 mA results in respiratory failure and ventricular fibrillation. The (lethal) electrocution threshold of human exposure to electrical currents is approx. 80 mA.

#### 3.3 Adverse effects of alternating current and direct current

Alternating voltage causes alternating current to flow through the human body, inducing vibrations in the muscular system and in the heart. The lower the frequency, the more dangerous the alternating voltage. This can result in ventricular fibrillation, which is lethal if first aid is not administered.

Direct current induces electrolysis, which causes damage to body tissue. This reaction causes substances to be released which can lead to poisoning. Such poisoning does not become apparent until several days after the accident and can be lethal if not treated in time.

#### 3.4 Adverse effects and lasting symptoms resulting from electrical accidents

##### Shock

Shock reactions at relatively low levels of current, where it is still possible to let go of the conductor, can cause injury due to uncontrolled movements and can impair the affected person's sense of balance.

##### Burns

Burns and scorching occur at the entry and exit points of the electrical current and internal burns can also be sustained. A resulting kidney overload can result in death.

##### Chemical reactions

Blood and cell fluids are electrolytically decomposed, causing serious poisoning which can often go unnoticed for days.

## Adverse effects on muscular system

Muscular contractions; brain coordination functions are affected. Typical consequences are impaired movement sequences, pulmonary contractions (respiratory failure) and cardiac arrhythmia (ventricular fibrillation, failure of heart pumping action).

## 3.5 First aid in case of an electrical accident

### 3.5.1 Procedures to be followed when rescuing persons who are in contact with an electrical source

The following procedures MUST be observed and followed:

- 1 - Your own safety has top priority.
- 2 - Avoid touching (i.e. direct contact with) persons who are connected to an electrical source.
- 3 - If possible, immediately de-energise the system (switch off the ignition or immediately remove the maintenance connector for high-voltage system - TW- ).
- 4 - Isolate the injured person or electrical conductor from the power source using an object made of non-conducting material such as piece of wood, broom handle or similar.

### 3.5.2 First aid procedures in case of an electrical accident

A - Procedures for the provider of first aid to follow if the injured person is not responding:

- 1 - **Check pulse and breathing.** Protected by copyright. Copying for private or commercial purposes, in part or in whole, is not permitted unless authorised by AUDI AG. AUDI AG does not guarantee or accept any liability with respect to the correctness of information in this document. Copyright by AUDI AG.
- 2 - Call or get someone else to call an ambulance.
- 3 - Give respiratory and cardio-pulmonary resuscitation (30 : 2) until medical assistance arrives.
- 4 - If the injured person stops breathing: use a defibrillator (AED) if one is at hand.

B - Procedures to follow if the injured person is responding:

- 1 - Cool any burn wounds and cover them with a sterile, lint-free cloth.
- 2 - The injured person must always see a doctor to avoid subsequent side effects.

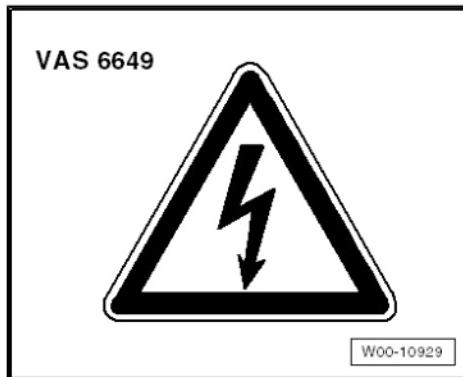
### 3.5.3 Procedures for accidents with batteries/battery fluids

- 1 - In the event of contact with the skin, rinse thoroughly with a large amount of water.
- 2 - If gases have been inhaled, ensure a large supply of fresh air.
- 3 - In the event of contact with the eyes, rinse thoroughly (i.e. for at least 10 minutes) with a large amount of water.
- 4 - If battery fluids are ingested, drink a large amount of water but do not induce vomiting.
- 5 - Seek the assistance of a doctor.

## 4 Tools

Hybrid vehicle warning notice (voltage) -VAS 6649-

Safeguard the working area before starting work on a high-voltage vehicle. The safety sign "Warning: dangerous voltage" MUST be displayed at the vehicle so it can easily be seen.



Hybrid vehicle warning notice (switches) -VAS 6650 A-

After the vehicle has been de-energised, the safety sign "Do not switch on, work in progress" MUST be displayed at the vehicle so it can easily be seen.



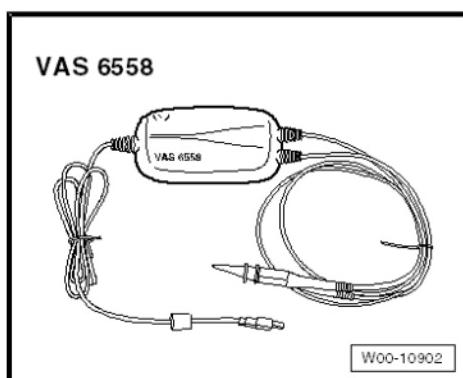
Hybrid vehicle warning notice (battery hazard) -VAS 6786-

If an undamaged high-voltage battery is temporarily put into storage, the storage area must be signposted with the safety sign "Battery hazard".



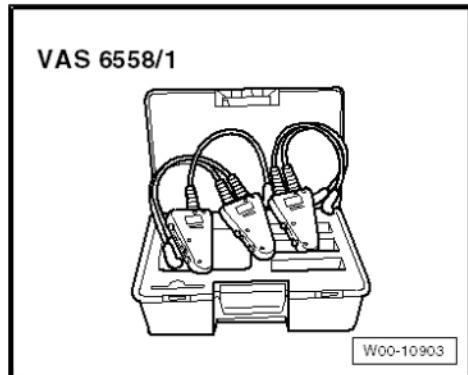
Hybrid test module - VAS 6558-

- ◆ The test module is used to measure the high-voltage insulation resistance and de-energisation on high-voltage vehicles.
- ◆ In addition, the hybrid test adapter set - VAS 6558/1 A- is required for connection of the test module -VAS 6558- .



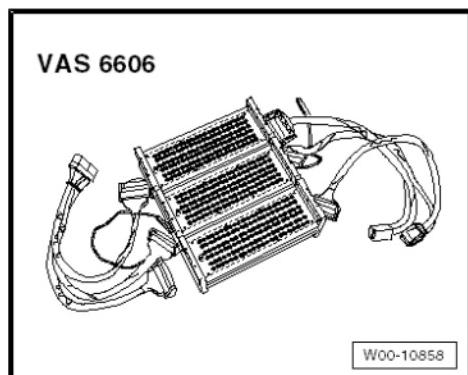
#### Hybrid test adapter - VAS 6558/1 A-

The test adapter set is used in conjunction with the hybrid test module - VAS 6558- for vehicle system diagnostics. The various adapters are used to carry out the insulation resistance test, check that the vehicle is de-energised and test the electrical air conditioner compressor.



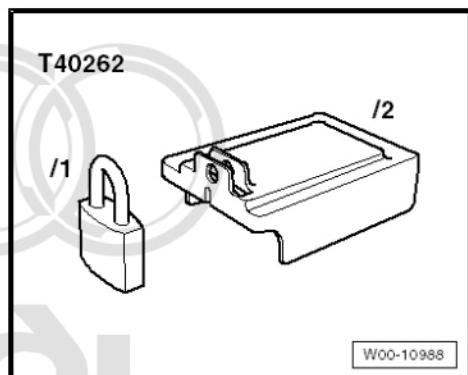
#### Test adapter -VAS 6606/10-

This test adapter can be used to perform measurements on the power electronics and battery management system in conjunction with the isolator box, 198-pin - VAS 6606- .



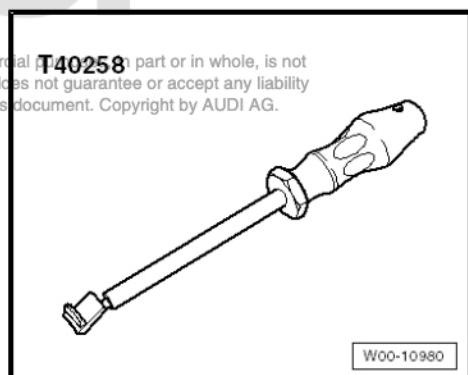
#### Locking cap -T40262-

The safety rules for work on electrical systems stipulate that, while the high-voltage system is de-energised, it must be safeguarded to prevent it from being re-energised. The locking cap is inserted above the socket on the maintenance connector for high-voltage system - TW- and locked with the associated padlock.



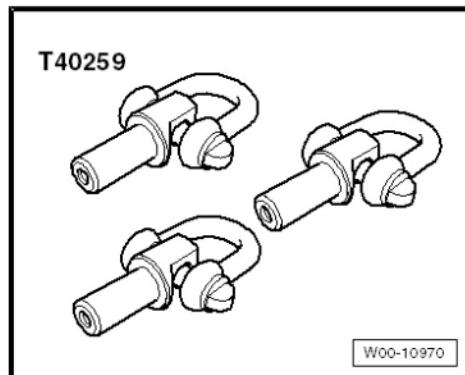
#### Release tool -T40258-

The release tool is used to lock and unlock the high-voltage connectors at the power electronics unit on Audi high-voltage vehicles.



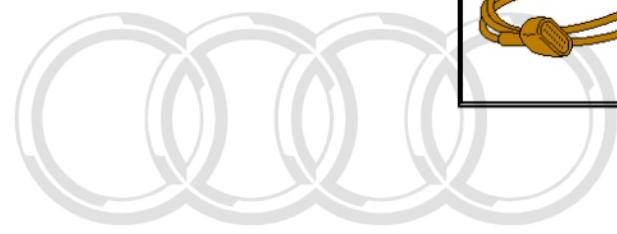
## Adapters -T40259-

The adapters are screwed onto the high-voltage battery at three specified points. This allows the battery to be lifted with the workshop hoist. The set -T40259- contains three adapters.



## HV diagnostic box -VAS 5581-

The high-voltage diagnostic box is required for diagnosis on autonomous high-voltage traction batteries. The high-voltage diagnostic box obtains its power via a power cable or a battery which can be ordered separately.



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## 5 De-energising / re-energising

- ◆ The **Guided Fault Finding** or **Guided Functions** on the vehicle diagnostic tester must be used in order to de-energise and re-energise the high-voltage system.
- ◆ Test logs must be filled in when de-energising and re-energising the system. The test logs are printed out during the test procedure, and must be fully completed, signed and enclosed with the repair order.

The workshop manual ⇒ Electrical system, hybrid; Rep. gr. 93 ; General warning instructions for work on the high-voltage system lists all work for which the high-voltage system has to be de-energised.



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## 6      Lithium-ion high-voltage battery

Failure mechanisms are initiated in case of a defective lithium-ion high-voltage battery. Serious defects generally trigger the shutdown of the entire high-voltage system. The lithium-ion high-voltage battery thus has a low risk potential.

### 6.1    Recommendation of multi-binding agent for oil and chemicals

The lithium-ion high-voltage battery in Audi high-voltage vehicles contains liquid electrolyte. A small amount of electrolyte can escape on vehicles with severe accident damage. This can be absorbed using appropriate binding agents and disposed of in the same way as petrol. Certain mineral-based multi-binding agents for oil and chemicals containing diatomite, mo-clay or vermiculite are suitable. Among others, the following products are suitable:

- ◆ Multi-binding agents for oil and chemicals (manufactured by Technolit)
- ◆ Absodan Universal (various manufacturers)
- ◆ Densorb granules, oil binding agent universal coarse grain, VOC-free (product name: "Densorb Granulat, Ölbinder Universal-Grobkorn", manufactured by Denios)
- ◆ Chemizorb (manufactured by Merck)

### 6.2    Workshop procedures for high-voltage vehicles

The following workshop procedures must be followed when an Audi partner receives a high-voltage vehicle. The workshop procedures for high-voltage vehicles can be found in the training documentation for the "Audi high-voltage technician" qualification module and in the ⇒ Audi ServiceNet , ⇒ Online Platform (B2B) and ⇒ ImportersNet systems.

### 6.3    Classification of a lithium-ion high-voltage battery



#### DANGER!

*High voltage can cause fatal injury*

*Danger of severe or fatal injuries from electric shock*

- ◆ *For reasons of safety, persons with life-preserving or other electronic medical devices in or on their body must not perform any work on the high-voltage system. Such medical devices include internal analgesic pumps, implanted defibrillators, pacemakers, insulin pumps and hearing aids.*
- ◆ *All work on the high-voltage system must be performed by a suitably qualified person (Audi high-voltage technician).*



#### WARNING

*Failing to observe recommended measures may lead to serious injury or death.*

Evaluation criteria			Classification	Measures		
Visual	Functional	Thermal		Repair	Storage/ quarantine	Packaging/ transport
<ul style="list-style-type: none"> <li>◆ No mechanical damage</li> <li>◆ No escaping fluid</li> </ul>	<ul style="list-style-type: none"> <li>◆ Battery can be diagnosed and there are no critical events in the event memory</li> </ul>	<ul style="list-style-type: none"> <li>◆ Temperature within specification</li> </ul>	NORMAL (green status): No measures necessary	No repair necessary	<ul style="list-style-type: none"> <li>◆ Inside in original packaging</li> <li>◆ Away from vehicle routes</li> <li>◆ Not stacked, pre-stored at floor level</li> <li>◆ 24 hours maximum</li> </ul>	<ul style="list-style-type: none"> <li>◆ Original packaging</li> <li>◆ HVT parts service</li> <li>◆ Parts prepared for dispatch</li> </ul>



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Evaluation criteria			Classifi-cation	Measures		
Visual	Func-tional	Ther-mal		Repair	Stor-age/ quaran-tine	Pack-aging/ trans-port
◆ Mechan-ical dam-age	◆ Battery can-not be diag-nosti-cally tested	◆ Sur-fac-e tem-perature has excee-ded mea-sured toler-ance range and is < 80 de-grees Cel-sius	WARN-ING (yellow status): Additional thermal faults	◆ No re-pair pair for vistine ual and ther-mal faults	Always quaran-tine	◆ Spec-ial pack-aging nec-essa-ry
◆ Strong smell	◆ Battery can be diag-nosti-cally tested and there are critical events for cell volt-age and tem-pera-ture in the hybrid bat-tery ener-gy man-age-ment - J840 -			◆ It may be pos-sible to repair func-tional dam-age, de-pend-ing on the scope of the repair being undertaken	◆ Out-side	◆ HVE to pack
				◆ Switch to green class-i-fica-tion level after suc-cess-ful re-pair - no mea-sures nec-essary	◆ In ve-hicle After re-mov-al, spe-cial pack-aging until item col-lected (same day)	◆ When trans-porting bat-tery from quar-an-tined area to work-shop leave bat-tery in vehi-cle (addi-tional mea-sures if a fire can-not be ruled out)



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Evaluation criteria			Classification	Measures		
Visual	Functional	Thermal		Repair	Storage/ quarantine	Packaging/ transport
<ul style="list-style-type: none"> <li>◆ Escaping fluid</li> <li>◆ Mechanical damage with open, accessible contacts</li> <li>◆ Fire, sparks</li> <li>◆ Smoke/steam</li> <li>◆ Noises (fizzing, crackling)</li> </ul>	<ul style="list-style-type: none"> <li>◆ Surface temperature has exceeded tolerance range and is &gt; 80 degrees Celsius</li> </ul>	<p>DANGER (red status): Acute/ immediate measures necessary</p>		<ul style="list-style-type: none"> <li>◆ Call fire brigade</li> <li>◆ Quarantine if possible</li> <li>◆ Switch to yellow classification level after vehicle quarantined successfully - additional measures necessary</li> </ul>		

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Escaping electrolyte can be noticed from its pungent smell. In this case, the vehicle must not be kept in closed rooms.

Within the "Guided Fault Finding" system there is a test program for classifying/assessing the condition of the lithium-ion high-voltage battery. The test program evaluates the condition of the lithium-ion high-voltage battery based on visual, thermal and functional criteria.

- Connect ⇒ Vehicle diagnostic tester.
- Select **Diagnosis** mode and start diagnosis.
- Select **Test plan** tab.
- Select **Own test** then the following options one after the other:
  - ◆ Body
  - ◆ Electrical system
  - ◆ 01 - Self-diagnosis compatible systems
  - ◆ 8C - Hybrid battery management -J840
  - ◆ 8C - Hybrid battery management, functions
  - ◆ A38 - Classification of hybrid battery

#### Thermal criteria

- Lithium-ion high-voltage battery becomes hot
- Battery housing becomes discoloured
- Plastic parts become distorted

#### Visual criteria

- Checking for scorch marks



- Checking for deformation
- Checking for dampness/water

#### Functional criteria

- Communication check to hybrid battery management -J840
- Critical event memory entries in hybrid battery management - J840

If the classification of the lithium-ion high-voltage battery shows that acute/immediate measures need to be taken, the first step is to submit a mandatory report or a technical repair query via DISS. Audi Product Support will then decide on the further procedure, or if necessary will send a specially qualified person to assist.

## 6.4 Storing and transporting the lithium-ion high-voltage battery

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The lithium-ion high-voltage batteries are classed as dangerous goods. As a result, some restrictions apply when transporting the batteries. These can vary between countries. Depending on the classification of a lithium-ion high-voltage battery, different types of packaging may be necessary - original packaging/recycling box for lithium-ion high-voltage battery.

#### Temporary storage of lithium-ion high-voltage batteries

- ◆ When the lithium-ion high-voltage battery is stored temporarily, it must be stored indoors and away from the direct vicinity of the workplace.
- ◆ The lithium-ion high-voltage battery must be kept dry and protected against adverse mechanical and thermal effects.
- ◆ When the battery is stored temporarily it must be stored in a location which is not accessible to non-authorised workshop personnel or customers (e.g. warehouse).
- ◆ The terminals on the lithium-ion high-voltage battery must be covered. To do this, use protective transportation caps or similar.

#### Renewing lithium-ion high-voltage batteries - no measures need to be taken for the high-voltage battery

- ◆ The lithium-ion high-voltage battery can be stored in its original packaging.
- ◆ Once removed, the lithium-ion high-voltage battery is placed in the original packaging and returned in that packaging.
- ◆ The lithium-ion high-voltage battery weighs approximately 40 kg; suitable equipment is recommended for transport within the workshop.
- ◆ The terminals on the lithium-ion high-voltage battery must be covered. To do this, use protective transportation caps or similar.

#### Renewing lithium-ion high-voltage batteries - measures for the high-voltage battery necessary

##### 1. Classification of the lithium-ion high-voltage battery according to the following criteria with the aid of the test program:

- ◆ Abnormal thermal condition of lithium-ion high-voltage battery
- ◆ Visible damage to lithium-ion high-voltage battery
- ◆ Functional irregularities of lithium-ion high-voltage battery

##### 2. Storage of lithium-ion high-voltage batteries if one of the conditions listed in point 1 exists

- ◆ Lithium-ion high-voltage battery remains in vehicle
- ◆ Vehicle must be stored outdoors, observing the following precautions:
  - ◆ Not in the immediate vicinity of buildings
  - ◆ Use sealed standing areas for vehicles with crash damage or place a drip tray under the vehicle below the lithium-ion high-voltage battery
  - ◆ Mark vehicle with -VAS 6649- and secure against direct access by unauthorised persons
  - ◆ If the lithium-ion high-voltage battery is exposed to the weather, the vehicle must be protected by a waterproof car cover

If the classification of the lithium-ion high-voltage battery shows that acute/immediate measures need to be taken, the first step is to submit a mandatory report or a technical repair query via DISS. Audi Product Support will then decide on the further procedure, or if necessary will send a specially qualified person to assist.

## 6.5 Procedures for high-voltage vehicles with defects/accident damage

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### DANGER!

*High voltage can cause fatal injury*

*Danger of severe or fatal injuries from electric shock*

- ◆ *For reasons of safety, persons with life-preserving or other electronic medical devices in or on their body must not perform any work on the high-voltage system. Such medical devices include internal analgesic pumps, implanted defibrillators, pacemakers, insulin pumps and hearing aids.*
- ◆ *All work on the high-voltage system must be performed by a suitably qualified person (Audi high-voltage technician).*



### WARNING

*Failing to observe recommended measures may lead to serious injury or death.*

1. The Audi high-voltage technician (HVT) must be informed if a high-voltage vehicle with defects/accident damage arrives at the workshop.
2. The workshop procedure for high-voltage vehicles must be followed.
3. A vehicle with accident damage must be parked outside in a quarantined area and kept under observation. The following points must be adhered to:
  - ◆ Not in the immediate vicinity of buildings
  - ◆ Use sealed standing areas for vehicles with crash damage or place a drip tray under the vehicle below the lithium-ion high-voltage battery
  - ◆ Mark vehicle with -VAS 6649- and secure against direct access by unauthorised persons
  - ◆ If the high-voltage battery is exposed to the weather, the vehicle must be protected by a waterproof car cover.



4. Note mandatory reporting obligations for vehicles with accident damage.

5. Note mandatory reporting obligations for high-voltage vehicle components

6. Run GFF test program to classify the lithium-ion high-voltage battery. The GFF test program can be found on the diagnostic tester by following the steps below:

- Connect ⇒ Vehicle diagnostic tester.
- Select **Diagnosis** mode and start diagnosis.
- Select **Test plan** tab.
- Select **Own test** then the following options one after the other:

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◆ **Body**

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◆ **Electrical system**

- ◆ 01 - Self-diagnosis compatible systems
- ◆ 8C - Hybrid battery management -J840
- ◆ 8C - Hybrid battery management, functions
- ◆ A38 - Classification of hybrid battery

7. If additional measures need to be taken for the lithium-ion high-voltage battery, the following applies:

7.1. Lithium-ion high-voltage battery remains in vehicle.

7.2. Inform high-voltage expert (HVE) at Importer.

7.3. Order recycling box/transport box for lithium-ion battery.

8. Keep lithium-ion high-voltage battery under observation in vehicle for 5 days; check the temperature of the battery regularly (at least twice daily) using a suitable temperature gauge (e.g. -VAS 6519- ). Inform the HVE regularly of the condition of the lithium-ion high-voltage battery.

9. If the lithium-ion high-voltage battery's condition does not remain constant, the quarantine period must be extended by another 5 days. Go back to number 8.

10. If the lithium-ion high-voltage battery's condition remains constant, the following applies:

10.1. HVE comes to the workshop.

10.2. HVE supervises transportation from the quarantined area to the workshop working area.

10.3. HVE removes the lithium-ion high-voltage battery from the high-voltage vehicle.

10.4. HVE packs the lithium-ion high-voltage battery in the lithium-ion battery recycling box/transport box designed for this purpose. The HVE must have completed the course on how to use the recycling box for the lithium-ion battery.

10.5. HVE fills in the transport documents.

## 7 Questions and answers

Q: Can I drive an Audi high-voltage vehicle through an automatic car wash?

A: Audi high-voltage vehicles can be driven through an automatic car wash; there are no particular restrictions.

Q: Can the engine on Audi high-voltage vehicles be washed?

A: The engine on Audi high-voltage vehicles may be washed as long as the usual environmental aspects are considered. If a high-pressure cleaner is used, it must not be pointed directly at the high-voltage components.

Q: What precautions need to be taken when towing the vehicle?

A: High-voltage vehicles are towed in the same way as conventional vehicles up to a maximum speed of 50 km/h with all four wheels on the ground.

Q: Can I charge or jump-start an Audi high-voltage vehicle?

A: Audi high-voltage vehicles are started by the electric drive motor - V141- integrated in the gearbox. The high-voltage battery always needs to have an appropriate charge level for this purpose. If necessary on an Audi high-voltage vehicle, both the 12 Volt battery and the high-voltage battery can be charged via the jump start terminal.

The charging capacity must be sufficient, i.e. the charger should ideally have a charging current of at least 30 A or the vehicle providing assistance should belong to the same size category as the Audi high-voltage vehicle. The transfer of energy from the charger or the other vehicle is displayed on the driver information system. The amount of time needed to charge the vehicle depends on the charge level of the high-voltage battery and the capacity of the charger or the battery on the other vehicle. It can take longer to jump-start a hybrid vehicle than a non-hybrid model.

Q: Does the end customer need special training for the Audi high-voltage vehicle?

A: The end customer does not need special training for the vehicle. The special instructions for hybrid models in the Owner's Manual must be followed.

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Q: Can the Audi high-voltage vehicle be driven without a high-voltage battery?

A: A fault in the high-voltage battery triggers defined failure mechanisms in the system. The high-voltage system is normally shut down if a serious problem occurs. The vehicle can only be driven until the 12 Volt battery is empty. The battery can no longer be charged when the high-voltage system is shut down.

Q: Do any special measures need to be taken when the Audi high-voltage vehicle is on a lifting platform, wheel alignment stand or brake test dynamometer?

A: The Audi high-voltage vehicle can be handled exactly like a normal vehicle. It should be remembered, however, that the engine can start up on its own when the ignition is switched on.

Q: Do any special measures need to be taken when the Audi high-voltage vehicle is on a performance test stand?

A: The Audi high-voltage vehicle can be handled exactly like a normal vehicle. Using the vehicle diagnostic tester it is possible to select an operating mode in which the vehicle is powered ex-

clusively by the combustion engine. In addition, the ESP should be deactivated via the button in the vehicle interior.

**Q:** What precautions need to be taken if an Audi high-voltage vehicle has to be painted?

**A:** The drying time for normal paint repairs is approximately 30 - 60 minutes with an object temperature of 60 °C, depending on the material and manufacturer. The air inlet temperature in drying cabins is usually 80 °C.

Audi high-voltage vehicles are equipped with a high-performance lithium-ion battery. However, this type of battery is fully functional only up to 55° C and cell damage can occur at temperatures over 70 °C

To prevent the battery-critical temperature of 70 °C from being exceeded, Audi high-voltage vehicles must not remain in the paint drier or in the drying cycle of a **combined cabin for longer than 60 minutes**.

If repair materials require a forced drying time in excess of the 60 minute maximum, an alternative drying method (such as infrared drying) must be used to dry these materials ⇒ Audi Paintwork manual .

**Q:** What service and maintenance work may be carried out by the customer on an Audi high-voltage vehicle?

**A:** The same maintenance work as on a conventional vehicle. Work of any kind on the high-voltage system must only be performed by qualified high-voltage technicians in authorised workshops in accordance with the Audi guidelines.

**Q:** What additional work has to be performed during the Delivery Inspection?

**A:** No additional preparations are required for the high-voltage components on an Audi high-voltage vehicle as part of the Delivery Inspection. Only the 12 Volt starter battery is inspected in addition to the usual Delivery Inspection checks. The electric drive motor - V141- is only used as a generator in transport mode. There is therefore no possibility of electric driving, boosting, start/stop mode or recuperation. The high-voltage battery is always charged in transport mode when the engine is running.

**Q:** What considerations apply to Audi high-voltage vehicles used as stock vehicles?

**A:** The standard VW Group checklist for stock vehicles applies. This contains a detailed description of the activities necessary over a given period.

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